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Effects of Climate Change on Ecosystem Services Provided by Hawaiian Coral Reefs

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A robust, modular model of reef and ecosystem services responses to both the long-term mean and the short-term extreme event components of climate change will be developed from the wealth of ecological and physiological data available for the coral and reef communities of Hawaii. Its output will be the input for the socioeconomic models, which will translate the climate change scenarios into a comprehensive picture of possible futures of the ecosystem services and socioeconomic sectors, activities, and costs for the region. The model (as well as the environmental data used and a comprehensive inventory of Hawaiian corals) will be available for both online use and download from a Web site (www.kgs.ku.edu/Hexacoral), providing for community involvement through hands-on testing and feedback.

This research project will integrate and extend existing models to develop a comprehensive, scenario-based analysis of the range of possible effects of global climate change on ecosystem services provided by the coral reefs of the Hawaiian archipelago, and on the economic valuation of predicted changes. It will build on an extensive base of coral, reef, environmental, and economic data and analyses already assembled for the region, using targeted surveys and experiments to characterize five diverse case study sites that will sample the region. Cross-scale (reef to Global Circulation Model [GCM] cell dimensions) and cross-domain (biological, environmental, economic) analyses will be carried out and integrated using domain-based typologies to classify sites and services, and to scale and integrate the impacts on services and values. A Geographic Information System (GIS) will be used extensively for visualization, analysis, integration, and communication of results.

In addition to systematic identification and valuation of potential changes in ecosystem services, broken down by service, environmental type, and socioeconomic sector, the project will emphasize the unique suitability of Hawaii and its indigenous culture for advancing methods of valuing both unused resources (the Northwest Hawaiian Islands) and the cultural and spiritual, as well as aesthetic, services provided by coral reefs. In addition to elucidating the interactions among climate change stressors and their relative effects on multiple ecosystem services, the project will develop and disseminate a suite of new and useful technical, methodological, and conceptual tools that will be broadly applicable to other systems.

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